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Gibson's Perfected Improvement in the Manufacture of Coal Gas.

PATENTED SEPTEMBER 19, 1871.

This mechanical device is an important improvement in the manufacture of gas, under the process patented by Mr. Gibson 5th October, 1869.

The dip-pipe and valve are combined together in one shell, but operate independently of each other. The dip-pipe is never closed, and consequently the gas can always find a passage into the hydraulic main through the dip-pipe seal. The valve-plug is so arranged as to only cover the direct communication with the hydraulic main, therefore whenever the valves are neglected and left closed, gas will be made as under the ordinary method. The handle of the lever used to open and close the valves may be so constructed as to rest upon the retort lid when the valves are open, so that the lids cannot be taken off without closing the valves.

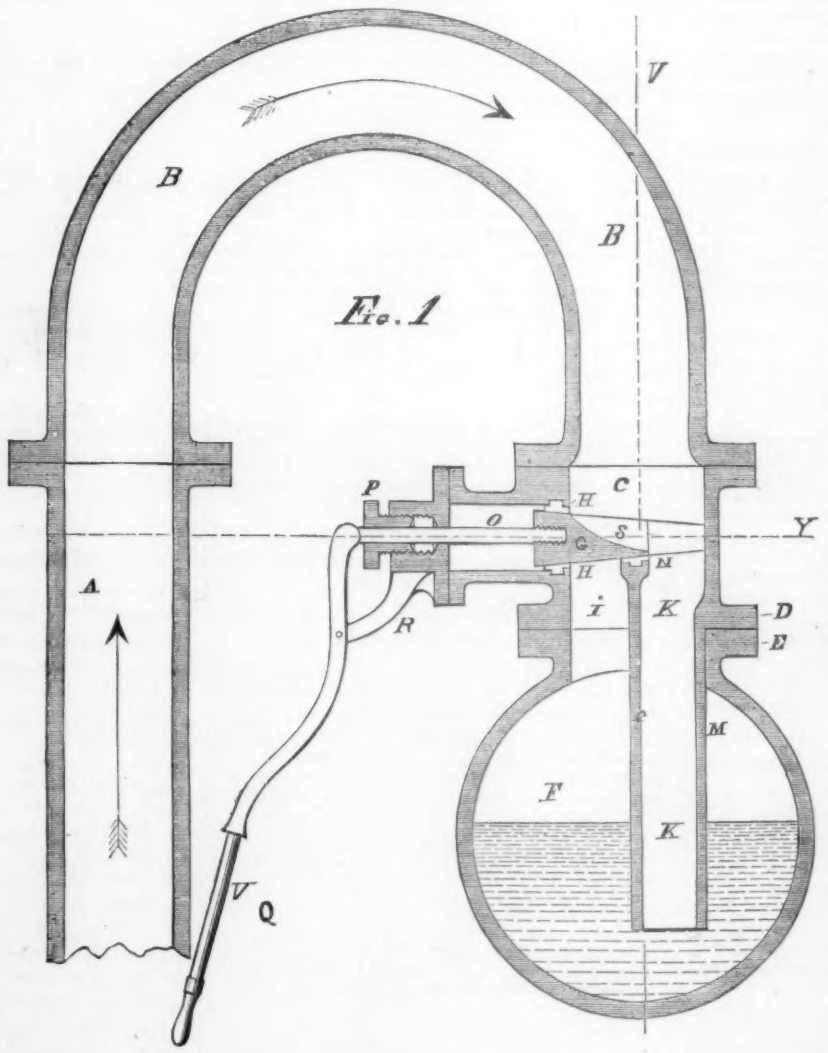

FIG. 1

a is the stand-pipe leading from the retort, where the gas is manufactured, and is connected to the the bridge-pipe *b* by means of bolts and flanges or suitable arrangement. The bridge-pipe *b* is connected by similar means to the valve-chest *c*, as shown. The lower end of the valve-chest *c* is also provided with a flange, *d*, secured to a flange, *e*, attached to the hydraulic main *f*. In the valve-chest *c* is the plug *g*, movable, having Babbitt or soft metal bearings *h h*, as shown. The lower part of the valve-chest *c* is divided into two separate channels, *i* and *k*. The former, *i*, is a direct communication from the valve-chest to the upper part of the hydraulic main, and the latter, *k*, is the seal that extends below the surface of the liquid in the hydraulic main as shown. The dip-pipe *k* is cast in one piece with the valve-chest *c*, and is composed of an upright wall, *l*, and a half circular wall, *m*. The upper part of the wall *l* forms a seat for the plug *g*, and is also provided with a Babbitt or other soft metal-bearing, *n*, on which the plug *g*, is closely fitted, so as to close effectually the passage *i* when the plug *g* is in a position as shown. I wish it to be distinctly understood that the plug *q* does not, at any time, cover the dip-pipe *k*, which always remains in open communication with the bridge-pipe *b* and the hydraulic main. The plug *g* is operated in the following manner: A spindle, *o*, is attached to the plug, *g*, as shown, and guided in a suitable stuffing-box, *p*, in which it is made to move forward and backward by means of manual power applied to the lever *q*, hung to the arm *r*, as shown. I do not, however, confine myself to this kind of lever arrangement, as any suitable construction of the lever and bearing will accomplish the same purpose. The upper side of the plug *g* is curved, as shown at *s*, and slopes toward the dip-pipe *k*, by which arrangement any liquids that are carried from the retort and lodged on the plug *g* will drop down easily into the dip-pipe *k* or passage *i*. The extreme forward end of the plug *g* is made thin and sharp, so as to scrape off the accumulations that may settle on the bearing *n* when the plug *g* is withdrawn from said seat *n*, and thus keep the seat *n* always clean. A conical shape is given to the plug *g*, as shown, by which arrangement the plug *g* will always wear itself to a true seat in its guides and bearings. I employ Babbitt or other soft metal bearings *h h n* for the plug *g*, but I do not confine myself to the use of soft metal only, as I could also make the bearings for the plug *g* of iron, cast in one piece with the valve-chest, or fit other kinds of metallic bearings thereto. The operation of my valve and dip-pipe is as follows: When gas is made in the retort I keep the plug *g* drawn back so that the gas can pass freely through the channel *i* to the hydraulic main without going through the liquid in the main; but when it is required to charge the retort anew or to repair the same, I close the opening *i* by means of the plug *g*.

Should the operator neglect to open the passage *i* when gas is being made, the result will be that the gas will pass through the dip-pipe *k* into the hydraulic main. as of old, and no accident can thus occur from over-pressure in the retort. From this it will be readily understood that my invention is an automatic or self-acting dip-pipe seal and valve combined, and that I never cover my dip-pipe *k* with the plug *g*, but keep the dip-pipe in open communication with the retort and the hydraulic main, whether said valve is open or shut.

WILLIAM GIBSON.

ST. JOSEPH, MO., is in darkness. The rear wall of its gas works has fallen in and wrecked the receiver, and now the high price of oil and candles in that city bids fair to ruin its citizens if it lasts much longer.

CHATTANOOGA, TENN., has experienced a delightful "sensation." Gas was lit upon its streets for the first time on the first day of the present month.

Chemical Repertory,

No. 57.—October 16, 1871.

EDITOR—HENRY WURTZ.

CHEMICAL EXCERPTS.

On Means of Preservation from Flame.—A. Patera,—This is an extract from a small work just published, by the same author. He made experiments on cotton, linen, wood, etc., with three kinds of salts. 1st, to 100 parts water were added 33 3 parts ammonium sulphate and 66·6 parts gypsum. 2nd, to 100 parts water, 25 parts borax and 25 parts magnesium borate. 3d, water-glass, 100 parts water 28 parts sodium silicate. Each of the three salts gave an almost equally favorable result. Patera found that cotton, linen and wood, after being impregnated with these salts and then exposed to the heat of an intense flame, burned in these places immediately exposed to the same; but that most of the substances were not in a condition to burn farther, and that but very few of them propagated the flame in a safe manner, and finally died out of themselves.—*American Chemist.*

77. Soluble Phosphates in Wheat Grain.—Prof. Crace Calvert has found that in *white or soft English wheat*, about two-thirds of the phosphoric acid, or phosphates existing in the wheat are soluble in water; while in *red or hard English wheat*, 100 parts of red wheat dried at 110 deg. C. furn shed 0·749 parts phosphoric acid, aud 100 parts of the same wheat dried at 110 deg. C. and crushed, yielded 0.376 parts of soluble phosphates, or about one half the total quantity.

78. Purification of Benzole.—A. W. Hoffmann.—Benzole is frozen in a cylinder, in which a perforated piston moves air-tight, stirred from time to time, in order to prevent the formation of large crystals, and the piston removed after some time, when the fluid hydrocarbons will go through the perforations of the piston, upon which rests a snow white column of benzole.—*Proceedings of German Chemical Society, in American Chemist.*

79. On the Constituents of the Water of the Rhine near Cologne, and its Fitness for Technical and Domestic Uses.—Dr. H. Voht.—By a series of analyses the author determined the quantity of impurities contained in the water of the Rhine, and established one fact beyond a doubt, namely, that it is greatly contaminated by sewage, which can hardly be removed by filtration.—*Am. Chem. from Dingler.*

80.—The Green of Leaves.—J. J. Muller.—The author states that on directing a spectroscopé at the under side of a leaf, on the upper side of which the sun was shining, he observed a spectrum stretching from F to B, but *without a trace of the dark absorption bands* which characterize chlorophyll. The inference drawn is the anomalous one, that the green of leaves is not leaf-green or chlorophyll.—*Am. Chemist.*

81. Meat-Preservation Patent.—H. Highton (We presume the Reverend, whose name has of late been so prominent in connection with more than dubious speculations in chemical dynamics) has turned his attention to more practical things than formerly, and the following invention is certainly ingenious in theory, whether efficient or not in practice:

"The general principle of this invention is the preservation of articles of food by the application of muriatic acid, and afterwards rendering them fit for consumption by neutralizing the muriatic acid with soda, and thus changing it into common salt.

"Meat or fish may be dipped once or oftener at intervals in dilute muriatic acid, then exposed to the air to dry, and before it is cooked be steeped in a solution of soda or its carbonates, which is best to be very dilute, till the acid is thoroughly neutralized. Any excess of soda may be got rid of by washing."

82. Existence of Nitrous Acid in Arable Soils, and on the Functions of that Acid therein.—M. Chabrier.—From this very lengthy monograph, we learn that nitrous acid is constantly present in soil, that this acid is partly converted into nitric acid, partly into other nitrogenous compounds. The average quantity of that acid found in the soil of market gardens amounts to 4·52 parts; corn-bearing soil, 2·16; orchard soil, 1·81; soil bearing fir trees, 0·75 parts; while a soil named safre (dried slime deposited by the river Durance) was found to contain no nitrous acid at all. It appears that the quantity and quality of the water which impregnates the soil has a great deal to do with the presence therein of the acid just alluded to.—*French Academy of Sciences.*

83. Malleable Iron Gas Retorts.—Dr. Dingler.—The author states that such retorts, forged at the iron works at Kaiserslautern (Bavaria), are now in use at several large German gas works, inclusive of that newly built at Frankfort-on-the-Maine, and that these retorts, besides being far less heavy, are also far more durable than cast-iron retorts.—*Dingler's Polyt. Journal.*

84. On the Meteorite of Golpara and on the Illuminated Tracks of Meteors.—G. Tschermak.—This meteorite consists of olivine, iron, magnetic pyrites and hydrocarbon, surrounding nodules of enstatite. To the presence of a *hydrocarbon* is attributed the illuminated tracks of some meteors.—*American Chemist.*

85. Freezing of Water.—M. Boussingault.—After briefly referring to the experiments of the Florentine Academicians, and of Huyghens (1667), on the force exerted by the freezing of water in closed metallic vessels, the author relates a series of experiments made by him last winter in order to ascertain whether water, when put into a strong vessel (a steel cylinder of great strength, and so arranged that the dilatation, or expansion, of the water, when cooled below 39°.4 F., could be prevented), would or would not remain liquid, even when exposed to a cold very considerably below its point of congelation, in consequence of the expansion due to the cooling down from below 39°·4 F., being prevented by the strength of the vessel containing the water and stopper (steel plug) fitted thereto. The result of this investigation was found to be that water remains liquid under the conditions alluded to, even at a temperature of zero Fahr., but freezes instantaneously as soon as the impediment, caused by the resistance of the plug which hermetically closes the steel vessel, was removed, and free play was given to the expansion of the liquid. It should be noted that the sides and bottom of the steel vessel alluded to were of such great strength as to be practically unyielding.—*Acad. of Sciences.*

86. Shoe Blacking without Acid.—Dr. Artus.—From 3 to 4 lbs. of lamp-black and ½ lb. of bone-black are well mixed with 5 lbs. of glycerine and treacle. Meanwhile, 2½ ozs. of gutta percha are cautiously fused in a copper or iron saucepan, and 10 ozs. of olive oil added, with continual stirring, and afterwards 1 oz. of stearine. The warm mass is added to the former mixture, and then a solution of 5 ozs. of gum senegal in 1½ lbs. of water, and one drachm each of oil of rosemary and lavender may be added. For use, the blacking is diluted with three to four parts of water. This blacking keeps the leather soft, and renders it more durable.—*Amer. Jour. Pharmacy.*

87. What Constitutes Patentable Novelty.?—It appears that some of the Examiners at the Patent Office have not yet been able to get into their heads what are the precise elements or requisites that go to make up a patentable invention, and have made some erroneous rejections. The Commissioner of Patents, the Hon. M. D. Leggett, in a recent opinion reviewing and revising one of these erroneous decisions, places before the examining officers, and the public in general, some very interesting and instructive information upon the patentable novelty of inventions. The gist of the whole matter is tersely stated by the Commissioner in this one sentence, "*The test of invention is the result attained*" In other words, if an improved result is produced, or if the public is supplied with a better article, or if the same article is produced in a cheaper, or quicker, or better manner, then patentable novelty exists, even though the devices are old by which the improved results are attained.—*Scientific American.*

Dr. Eveleigh s Process of Gas Making.

By a vote of the Common Council of the city of London, the Special Gas Committee of the Corporation have been requested to visit the works of Dr. Eveleigh, at Peckham, and to report to the Court whether, in their opinion, the process is calculated to supply the public with gas of a superior quality at a lower cost than at present. The process of Dr. Eveleigh, so far as can be gathered from his patents, has been more than once described in our Journal, but as it is now attracting considerable attention, we may mention it again.

The first patent is dated January 7, 1869; some improvements have been patented since, but the specification of these has not yet been printed. The patent of 1869 includes a process for the purification of mineral oils, and the application of gas to heating purposes; but so far as it relates to the manufacture of gas the process may be described very shortly. Coal is first distilled in an ordinary retort, and the gas produced is made to pass through a series of what are called "redistillation retorts." These are cylindrical vessels set vertically in a furnace, and so connected that the gas passes from one to the other through the series. They are packed the greater part of their height with charcoal and lime in small lumps, and at the top of each is a layer one or two inches thick of iron filings or turnings. The first of the series is in connection with a reservoir of creosote, oil, or petroleum, and, according to the specification, when the flow of gas from the retorts in which coal is being distilled slackens, and the redistillation retorts become sufficiently heated, the liquid substance in the reservoir, tar, creosote, petroleum, or whatever it may be, is allowed to flow slowly into the first redistillation retort. No doubt, as stated in the specification, "the oil or other liquid is soon vaporized in the redistillation retorts;" but we must leave our readers to form their own conclusions as to the probable truth of the following explanation of other changes said to take place: "Bicarburetted hydrogen and carburetted hydrogen are separated from the gas and vapors passing over from the retorts, and produced from the oil. The other parts, such as ammonia, carbonic acid, pitch vapor, water, creosote, naphthaline, and the like, are decomposed by the 'chemical purifiers' (that is, lime, charcoal and iron filings) in the redistillation retorts, the result being the production of more bicarburetted and carburetted hydrogen, carbonic oxide, cyanogen, and free hydrogen, which pass forward, together forming a good available lighting gas." To our mind this looks more like a carburation process than anything else, for we have great doubt about the breaking up of heavy hydrocarbons into permanent gases, except under circumstances very different to those which can obtain in these redistillation retorts. It will be remembered that many years ago Mr. Basford passed raw gas through a second retort filled with coke or charcoal, with the idea of breaking up tar into permanent gas; but the only result was the production of a large quantity of naphthaline, which soon deposited, and left a comparatively poor gas.—*London Journal of Gas-Lighting.*

British Association of Gas Managers, June 14, 1871.

[Abstracts by the Editor of this Journal.]

[Continued from page 100.]

ON GAS MEASUREMENT.

By Mr. Hartley of Westminister.

The tendency of recent legislation on gas matters appears to lie in the directions of an increase in the illuminating power and of a diminution in the selling price. It follows, therefore, that dividends have now, and will in the future have to be realized upon gas yielding a smaller per centage of profit on its cost than that obtained in days gone by. Gas manufacturers have not been wanting generally in earnestness and industry in seeking to lessen the cost of production, and to a certain extent their efforts have been rewarded; but, judging from experience, and with our present knowledge of the subject, it certainly may be assumed that so long as it continues necessary to produce gas mainly or entirely from coals, its first cost will not be brought materially below the present standard in well conducted works. It is, therefore, a manifest fact that if, at reduced selling prices and enhanced quality, the full dividends are to be secured, they must be realized by bringing the largest possible proportion of the gas made into charge. Most companies are to a greater or lesser degree sensible of this, and by careful attention to the condition of mains and services, and to the adjustment of the supply pressures during the day and night to the requirement of the consumers, and also by the application of regulators to the public lights, have effected importan reductions in the percentage of unaccounted for gas; but there is yet another part of the distributing apparatus which has not yet received the attention which it deserves—namely, the measures by which the consumption is estimated.

The gas-meter, whether wet or dry, is such an admirable machine, and does its work generally so well, while demanding so little attention, that it seems as though it were forgotten that the meter is, after all, only a production of mechanical ingenuity, and, like

all other machines, requires a certain amount of supervision and correction. Every practical man must be cognizant of the difficulty, nay, the impossibility of producing machines, whatever be their character, which shall be perfectly free from liability to derangement, and it is in the highest degree absurd to expect that the gas meter should be so pre-eminently perfect as to be exempt from the frailities which are inherent to the offspring of human ingenuity. Yet the author has known of hundreds of cases in past days in which wet meters have been allowed to remain for long periods in use with a deficiency of water in them, and of dry meters being continued in use long after they must have become imperfect, and even in a practical sense worn out. It is true that the limited water range now permitted compels a more frequent and regular attention to wet meters, but still sources of derangement exist; and it is notorious that if a dry meter be continued in action too long uncleaned, it is susceptible of changes which may seriously prejudice the interests of the seller of gas. That such things as these are true in no way militates against the reputation and trustworthiness of the instruments when rightly regarded. Probably there is no other automatic machine which receives and really requires so little attention, does its work so easily, and, as far as circumstances will permit, so satisfactorily, as the gas meter. Yet this machine is, unfortunately, a prolific source of discord between the buyer and the seller of gas, and simply, it seems, because too much is expected from it, and because in addition the unscrupulous assertions of agitators and of some unwise meter makers, have excited the distrust of the public, who have been led to look upon gas meters as mere "conjuring boxes," which the companies, at will, cause to indicate large or small (generally large in the public mind) quantities of gas irrespective of consumption, by some mysterious operation of "pressure;" although of what pressure means, or in what way it can affect the action of a gas meter, the public remain in profound ignorance in spite of all the efforts which have been made to enlighten them.

It thus came about that, almost *pari passu* with reductions in the price of gas, and therefore, in an economic sense, the lesser need to the buyer for its exact measurement, the public distrust grew in strength; and this distrust has been but partially allayed by the operation of the Sales of Gas Act, which was passed in the year 1859, and modified by two subsequent Acts. Gas companies and meter makers generally were quite disposed to welcome any Act of Parliament of a nature calculated to relieve them from unjust suspicion, and at the same time protect the interests and satisfy the minds of the public. Unfortunately, the Sales of Gas Act, was and still remains, a very imperfect measure, in spite of the efforts made at various times by gas companies and meter makers to obtain such alterations in it as would render it really efficient. It is true that the Act has to a considerable extent served the purpose it was intended to accomplish; but that it has done so is due almost entirely to the intelligence, common sense, and integrity of the inspectors who have had to carry its most important provisions into effect.

The Act is full of imperfections; but its radical defects, in so far as gas interests are concerned, are firstly, its permissive character—it is only legally operative in any place or district after the magistrates or other duly constituted authority of such place or district have resolved to adopt it. Secondly, its rules for testing meters are so inadequate to the requirements of meter testing that they render the legal verification of many meters simply impossible by the instruments at the command of meter inspectors; and further, the rules provide for no examination of the indexes of the meters.

The effect of the permissive character of the Act is, that after an existence of 10 years it is now only legally operative in one county and 52 cities and boroughs in England; so that two important purposes which the Act was intended originally to serve—namely, the compelling of all meters to be stamped, and the establishment of inspectors locally, in order that they might be readily appealed to in case of dispute—are, to a great extent frustrated. That verified and stamped meters are almost universally employed throughout the kingdom renders the present state of the law scarcely the less objectionable; for, although the stamp on a meter may be referred to, and a certificate of registration produced in any district, yet such evidence will not carry conviction into the minds of consumers so well as would the testimony of a local inspector who might possibly be a man well known and respected by those who appealed to him.

Mereover, a system which necessitates many meters to be sent miles away to be tested, and to an inspector unknown to all parties concerned, is little likely to satisfy consumers. The opportunity given to the company, in many instances to have the meter altered and adjusted before it reaches the inspector, must excite the suspicion of consumers; and, although the author is quite aware of the groundlessness for such suspicion, still he knows that it is at times excited, and that the results of official testings have been, in consequence, discredited. Expense, too, is another element which is of some importance when a meter is sent far away. The verification of meter indexes is a matter of vital importance. Under the present system, a meter may be fitted with an erroneous construction, or one intended for a meter of another size, and such meter may be verified and stamped without any discovery, by the inspector, of the false registration. Meter makers, as a matter concerning their reputation, take every imaginable care to avoid errors in respect to indexes; but so they also do, and have done in times past, in respect to the actual measuring capacity of their meters; and, if it be deemed needful to verify meters in respect to capacity, in which the *smallest* amount of error is possible, surely it is of much greater importance to verify the *registering* apparatus, in which the *largest* amount of error may be made.

The matter—that is, the making of mistakes—concerns gas companies more than meter makers. Many gas-fitters undertake the repair of meters, and do them somehow for consumers, and in their hands indexes may be altered erroneously, or wrongly changed, and the discomfort resulting, sooner or later, is certain to fall on the gas company, and the discredit possibly on the maker of the meter. If the index were verified, this source of error would be avoided. The testing of large meters, in a legal manner, is rendered impossible by the rigidity of the rules which have to be observed, and the positive insufficiency of the apparatus which an inspector has to employ, and is able to employ, in many instances. It is enacted by this Act that every meter shall be tested under a pressure of 5-10ths of an inch of water, and when passing the quantity of gas or air per hour which shall be marked on the meter as its measuring capacity per hour. The instruments which the authorities put into the possession of the inspectors, in order to carry the testing rules into effect, are gasholders of 1 1-10, 5 1-2 and 11 cubic feet capacity. Of these sizes the 11 cubic feet gasholder is mostly employed. Now, at the outset, there are practical difficulties in the way of putting connexions of a larger size than 2 inch to an 11 cubic feet gasholder, as there are also in the way of *using* holders with larger connexions. Hence the maximum rate of delivery of air or gas from a holder is soon reached, and it is found that, with one 11 cubic feet holder, it is impossible to deliver gas under 4-10ths pressure fast enough to work any meter above about 80 or 100 light size at full speed; but, even assuming that a 100-light could be so tested, a difficulty arises. A 100-light wet meter should deliver 5 cubic feet of gas per revolution; two revolutions nearly exhaust an 11 cubic feet holder; and much more than such quantity must be passed through fairly to test the meter. Thus with one holder the test must be intermittent, and this method of testing is very likely tolead to error. It is true two holders could be used, and consecutively filled and discharged. This would meet the requirements perhaps of a 100 light, and at the same time give the inspector just as much work to do as one man could accomplish. Much larger meters than the 100-light size are used in most towns, and in order to test such meters according to legal rules, it would be needful for the inspector to be provided, at an enormous expense, with many holders and their accompaniments, to have a staff of experienced assistants, and a large establishment to keep the apparatus in. No corporate body would feel or have felt justified in incurring such an expense as would enable an inspector to comply with the legal requirements of extreme or even of mean cases.

But the difficulties do not terminate at the point indicated, for clause 20 of the Act empowers an inspector to enter a consumers premises and therein test the meter, or to have it removed for testing. Many consumers' meters are very large, and are fixed in such situations that their removal would be attended with difficulty, expense, and even destruction of property. Such meters must be verified *in situ*, but unless the inspector bring to the place a number of gasholders and fittings at a great cost, he cannot test the meters in a legal manner. Hence it is that inspectors have not hesitated to violate the rules, and to make the best tests in their power, by the use of one gasholder, and at whatever rate of working possible, while the test for leakage under 3 inches pressure has been in most cases entirely neglected. There are hundreds of meters in use which have in this way been illegally verified and stamped. It is now fully time that earnest efforts were made to alter a state of things which will some day cause serious discomfort to many gas companies. It is a field which may yield a prolific crop of distrust in respect to gas companies, meter inspectors, and meter makers. It may be said, if the rules laid down by Parliament for the protection of the consumer be violated in one direction, that in no other direction is the Act to be relied upon, and as a consequence disputed accounts will multiply in number. Consumers may not be inclined to rest satisfied by a statement of the fact that the registration of a meter, especially of a wet meter, may be just as accurately determined at a low rate of working as at full speed.

What is needed is a complete alteration in the system of verifying of large meters; the rate of working must be left to the discretion of the inspector, the condition as to pressure abolished, and the testing instrument be a meter instead of a gasholder. The operation will then become easy and accurate, and of course legal, instead of being, as it now is, troublesome, of doubtful accuracy, and illegal. The writer has for years been an advocate for the use of test meters by inspectors, and, in conjunction with others, sought to render it a legal instrument before the Sales of Gas Act came into operation. He has at last the satisfaction of seeing it included among the standards of the Board of Trade, and rendered a legal secondary standard of cubic measurement by an order in Council, dated the 24th of March last. The Government authorities are now prepared to verify test meters, and it only now remains for those who are interested in meter testing to seek for the removal of all impediments to its use.

The Royal Commission on Weights and Measures made what the author cannot but think to be a great mistake, by including the dry meter among the secondary standards. Certain it is that no inspector who who possesses any practical knowledge of meters would think of using a dry meter for testing purposes, even if such meters were likely to stand the process of verification at the Standards Department. The most material reasons against the dry meter, and in favor of the wet, for *testing purposes*, are as follows, and these reasons were submitted by the author to the warden of the standards in July last:

Dry Meters—Reasons Against.—The measuring-chambers are composed partly of flexible material; and measurement is, moreover, dependent on the preservation under all conditions of use, of the absolute soundness of the slide valves, by which gas or air enters into, and is discharged from the measuring chambers. The dry meter is subject to disturbing influences, which alter its measuring capacity, and the existence of such disturbing influences could not be known at the time of using the meter, or even before or afterwards. The meter might, under conditions apparently identical, or at all events under conditions in which an inspector could use it, vary to the extent of two or three per cent., and the inspector know nothing of such variation. No means can be devised which will enable a dry meter to give internal or external evidence of its measuring condition, and therefore it would become necessary, if the dry meter were used for testing purposes, to reverify it at frequent intervals.

Wet Meter—Reasons for.—The measuring wheel of a wet meter is composed of inflexible material, and is practically incapable of any variation in capacity, except that produced by the elevation or depression of the water level. The measurement is, moreover, independent of any valves whatever. It is free from any influences capable of disturbing its measurement when used under conditions, which the inspector can command and control. It affords internal evidence of its own measuring condition, for the wheel being inflexible and unchangeable as to dimensions, and the depth of its immersion being defined by lines upon water-level gauges, it follows that it is only necessary to charge the meter, on every occasion of using, to the lines on the gauges, to secure optical evidence of the meter's measuring condition; retesting it at frequent intervals is unnecessary.

The standard test meters are respectively 20-light and 100-light size. The 20-light model before the meeting shows the construction adopted. The wheels are made of very stout icorrodible metal, and the cases are also lined with the same metal one-eighth of an inch thick; so that the meters are as durable in character as the other Government standards. The standards of cubic measurement now comprise three distinct kinds of instruments—viz., the *cubic foot bottle*, the *test gasholder*, the *test meter*. These instruments differ widely from each other in character and mode of measurement, and the writer believes it will be of interest to consider briefly the conditions under which each may be used in order to secure accurate measurement; the dry meter may, however, be passed over, because the reasons already given show that it is not fitted for testing purposes. At all events, the writer has failed to discover any means by which it can be made to satisfy the requirements of meter testing or of very precise measurement. The cubic foot bottle is merely an outcome of the late Mr. King's "Transferrer." The "Transferrer," in truth, consisted of a cubic foot bottle mounted above an air-chamber, and communicating therewith by means of a siphon pipe provided with a cock, so that connexion between the bottle and air-vessel could be established or cut off at will. The hypothesis on which this instrument was constructed is, that if the upper vessel or bottle be charged with water, and the water then be discharged into the air-vessel below, a quantity of water exactly equal to the volume of water admitted would be expelled from the outlet of the air-vessel. The suggestion of the bottle form for a cubic foot measure was not lost upon the Astronomer Royal and Professor Miller, and this form was adopted for the standard, with the idea apparently of using it in some such way as Mr. King had devised. Unfortunately, Mr. King's

hypothesis was not borne out by the experience of any one who worked with the transferrer. It was found that the volumes of air discharged from the chamber sensibly differed, and that it was impossible to control or even to fully realize the circumstances which induced the variations. In addition to which objection, the labor was considerable, for 62.321 lbs. of water had to be lifted for the purpose of charging the bottle for each cubic foot of air measured, and the operation was altogether slow and tedious. The writer was greatly distressed in his efforts to use the transferrer for the graduation of test gasholders in the year 1861, and after a week's unprofitable labor cast the transferrer aside, and applied the bottle as a direct measurer, being at the time quite unaware that Mr. George Glover had devised the direct transferrer. The writer ventures to think his method the best. The measurement is nearly automatic, requiring little more than a very moderate increase and reduction in the counterpoise by means of convenient loose weights, in order to discharge and recharge the bottle. On this method the operation of measuring a test gasholder is reduced to the minimum in labor, is exceedingly expeditious, and if the operator be experienced, the results are almost unfailingly accurate.

[To be continued.]

Condensed Abstract of the Gas Referees Report on Burners.

[By the Editor.]

[Concluded from page 101.]

THE EFFECT OF THE TEMPERATURE OF GAS ON ITS ILLUMINATING POWER.

This question has been little investigated; but, in the main, it has been held that the warmer the gas supplied to the burner, the greater will be the amount of light obtained compared to the quantity of gas consumed. The most recent experiments are those made last year, in the laboratory of the University of Munich. The normal temperature of gas was taken to be 64½ deg. Fahr., and the illuminating power of gas at this temperature as 100.

1. *First, as to the Effect of Heating the Gas.*—When the temperature of the gas was increased to 238 deg., the illuminating power rose to 118, showing an increase of 18 per cent. in the illuminating power of the gas in consequence of the rise of temperature. Such results appeared to the referees inexplicable on any grounds yet known. When gas is raised to a high temperature, a loss of illuminating power is incurred, chiefly from a deposit of the light-giving carbon-elements of the gas.* But at any heat which does not thus alter the constitution of the gas, the only result of raising the temperature must be to increase its volume by expansion; and the effect of this expansion would simply be that, under the same pressure, *less* gas would pass through the burner in the same time when the gas was heated than when it was cool. Or rather, the gas being heated *after* it has passed through the meter, and the meter being made to pass (say) five feet an hour, then the heated gas, being enlarged in volume, would have to pass *more quickly* through the burner if the gas were cool, *i. e.*, of the same temperature as it had when passing through the meter. Accordingly, as seemed to the referees, the only result to be expected from heating the gas would be to make it pass through the burner with greater velocity—in other words, under more pressure.

As regards burners two opposite views have been held—the Leslie burner having been devised on the theory that the gas should be heated as much as possible before being ignited; while Mr. Sugg and others, more recently, adopt the opposite opinion, and make their burners, in whole or in part, of non-metallic substances, in order that the gas may be heated as little as possible. The referees made the following series of experiments: A 12-feet coil of half-inch metal pipe was placed in a water-bath; a metal pipe 18 inches long led from the top of the coil to the burner, surrounded with a jacket filled with boiling oil, extending to within two inches of the point of ignition; the thermometer at once rose to 296 deg. Fahr., *i. e.*, to the highest temperature attained in the experiments made at Munich.

We also made a bye-pass from the meter to the burner, through which the cool or unheated gas might be supplied to the burner; and the apparatus was so constructed that the burner could be supplied instantaneously with cool and with heated gas alternately; so that any change of illuminating power, produced by a high or low temperature of the gas, could be readily noticed. But *the heated and the cool gas gave exactly the same amount of illuminating power.*

The heat of the flame of a Bunsen burner is said to be about 1,800 deg. C. (3,272 deg. F.) and the heat of an ordinary gas flame, as found by us, is still higher; so that the difference between the ordinary temperature and the highest at which it is practicable to supply gas to a burner is quite insufficient to make any appreciable difference in the temperature of the gas flame.

Indeed, as a practical question, *the only means of affecting the temperature of gas at the point of ignition is by the shape and material of the burner itself.* Now, as the temperature of a metal burner, when the gas is lighted, is about 500 deg. or 600 deg. F., (more than *twice* as great as that obtained, either in our experiments or in those at Munich, by heating the gas before entering the burner), and as the gas nearly acquires that high temperature in passing through the heated burner, it is obvious that any lesser degree of heat imparted to the gas before entering the burner can be of no use at all.

As a practical deduction from the preceding experiments and reasoning, it appears that the advantage at present supposed to be derived from making burners of non-metallic substances (steatite, porcelain, etc.) in order to keep the gas at as low a temperature as possible at the point of ignition, is wholly imaginary. For although *theoretically*, there is an advantage in keeping the gas comparatively cool, in order to lessen the *pressure* at which it issues from the burner (an object which can be more simply and perfectly attained by the construction of the burner itself), it is not less true that, theoretically, it is advantageous to make the gas as hot as possible at the point of ignition in order to get a higher temperature in the gas flame. But, we repeat, the above experiments demonstrate that neither of these opposite influences is of sufficient power to affect the ordinary conditions of gas-combustion, and consequently the illuminating power. The only advantage, therefore, (and it is a considerable one) of using non-metallic substances in the making of burners arises from their superior endurance, as they are not liable to oxidise like metal burners.

II. *Secondly, as to the effects of Cold.*—At Munich, when the temperature of the gas was brought down to 32 deg., the illuminating power is said to have been reduced on the average 20 per cent. And when the temperature of the gas was still further lowered, by using a mixture of salt and snow (temp. 4 below zero), the illuminating power was reduced by nearly one-third, ranging from 33 to 40, as against its full illuminating power of 100.

The latter temperature (—4 deg. F.) is one to which, in England at least, gas is never subjected; but at 32 deg. F., and a little below it, our experiments showed no difference in the illuminating power. By means of the bye-pass above mentioned, gas at the freezing point, and at a temperature of 296 deg. F., was supplied alternately to the burner without making any difference in the readings of the photometer—so that the mere *cooling* of the gas (like the heating of it) has no effect whatever upon its illuminating power.

At the same time, when gas is subjected to a freezing temperature for some time, the water contained in gas, in the form of aqueous vapor, is separated in the form of ice, and a portion of the illuminating hydro-carbons are condensed along with it.

THE EFFECTS OF DISTANCE FROM THE GAS WORKS UPON THE ILLUMINATING POWER.

On this point, as indeed on almost every other connected with gas, a diversity of opinion has hitherto prevailed. The general opinion is, that gas loses a portion of its light-giving power in proportion to the distance which it has to travel. And in the London Gas Acts of 1868-9, the companies successfully insisted upon having their testing-stations placed at not more than 1000 yards from the works.

The recent opening of the new works of the Chartered Company at Beckton has enabled the referees to make experiments of a very important kind upon this question; for the distance from the place of manufacture at Beckton to the point in the city where the supply begins is nearly nine miles. A series of experiments was made at Beckton, and also upon the same gas when it arrived at the Brick Lane Station of the Chartered Company; and the result of those experiments proved that the illuminating power of the gas did not appreciably suffer from the great distance which it has to travel.

The gas thus tested gives on the average a light equal to that of 17 candles—so that it is a somewhat richer gas than that supplied to London generally; and since no material loss of illuminating power takes place in it, it may be safely maintained that the ordinary 14 or 15 candle gas can travel a similar distance without damage.

It is to be observed that the gas from the Beckton Works is supplied in unusually large quantity, and in a pipe four feet in diameter—circumstances which materially tend to counteract any evil effects from the distance which the gas has to travel; because the great quantity tends to maintain the conducting pipe at a suitable temperature, thereby lessening the tendency towards undue condensation.

In order to ascertain the effect of withdrawing the aqueous vapor from gas, we made several experiments by passing gas through porous chloride of calcium—the result showing that dry gas has a superiority in illuminating power over ordinary gas to the extent of from six to eight per cent; but of course the gas loses proportionately in volume.

It seems probable that, in some cases, gas may actually acquire a slightly higher illuminating power (but with diminished volume) at a distance from the works than it had on leaving them.

THE TRANSPARENCY OF GAS FLAMES TO LIGHT.

If a printed paper be held behind the flame of a batwing or fishtail burner, consuming common gas, the print becomes manifestly less distinct when viewed through the upper or white part. And when cannel gas is used, the obstruction to vision produced by this white portion of the flame becomes still greater. But it does not necessarily follow that the flame impedes the transmission of light. It unquestionably obstructs sight, but does it obstruct light? A superior light always tends to render invisible an inferior light *of the same kind* placed behind it. If a gas flame impedes the transmission of light from other gas flames placed behind it, then there is, *pro tanto*, a defect in the argand burner; for the light from one portion of the circular flame of the argand has always to pass through the other portion.

If a gas flame does impede the transmission of light, then burners should not be arranged in such a manner that the light from one of them has to pass through that of the others—or even through a part of itself, as happens when a batwing or fishtail burner is placed edgeways to the point of sight. To determine this point, namely, the transparency of gas flames to the light of other such flames, the following experiments were made:

Three flat flame burners (Sugg's No. 7 batwings) were fixed two inches apart on a stand, consisting of a piece of tubing, in such a manner as to allow the positions of the flames to be changed without altering the consumption of gas, and with the central burner always remaining at the same distance from the photometer disc.

The following rough diagram will show, perhaps, more clearly than a verbal description, the effect of the several arrangements of the gas flames (marked —) upon the amount of light received from them on the photometric disc, marked *:

Other similar experiments are described with five burners.

From both of these experiments, however, it appears conclusively that gas flames are not perfectly transparent, and considerably obstruct the light of other such flames placed behind them. Hence it is probable that the less perfect results obtained from Sugg's larger argands compared with his smaller ones may be due to a greater loss of light by obstruction in the former than in the latter. Also, as above shown, the loss of light by such obstruction was greatest when the flames were placed edgeways to the photometer, in which position the depth of flame through which the posterior light had to pass was greatest.

CONCLUSION OF FIRST REPORT.

I. It has been shown, by conclusive experiments—in opposition to the prevalent doctrine (embodied and exaggerated in the recent "Farmer Theorem")—that gas may be used in any quantity with equal results as regards the development of its light; the differences being wholly due to the burners—each burner doing most justice to the gas at a certain rate of consumption, and giving bad results when the consumption is either greater or less than that rate.

II. Whether gas be supplied heated or cool (*i. e.*, at the ordinary temperature) to the burner, makes no difference in the illuminating power.

III. Their investigations appear to indicate that the opinion that the illuminating power depends upon the length of time that the carbon-atoms are kept in a state of incandescence, and consequently that the more slowly the gas is consumed the higher will be its illuminating power—is imperfect as an explanation and partly erroneous. They also show that an important, if not the chief, cause of imperfect illuminating power is the comparatively low temperature of the flame.

IV. It has also been shown how adverse to the illuminating power is an excessive draught, or over supply of air, to gas flames; for (apart from some other effects not yet adequately ascertained) such draughts not only throw too much air upon the surface of the flame, but may cause the air to intermingle with the gas, thereby introducing into the flame in incombustible body, which lowers the temperature of the burning gas by absorbing a portion of its heat.

* The temperature at which this change in the constitution of gas commences has not yet been accurately ascertained; but the referees are at present engaged in experiments on a large scale connected with the purification of gas from sulphur which, *inter alia*, will determine this point.

V. The evil effects of "pressure" have been shown to be due to the same cause—the tendency of pressure being to increase the draught upon the flame. And it has been shown that gas gives its maximum of illuminating power when it is consumed (*i. e.* issues from the burner) under little or no pressure; in which case the gas flows upwards like the vapor of natural flames, simply by the ascending power due to its lightness relative to the surrounding atmosphere.

Even when burning at the rates best suited to them, some burners give much more light in proportion to the quantity of gas consumed than others; the difference between good and bad burners being so great that the best give 70 and even 80 per cent. more light than many of the burners in common use. As a question of practical consumption of gas, it is true, the loss of the public from bad burners is never so great as these figures show, but certainly it may be taken at from 25 to 40 per cent. Hence, it is of great importance to the public, alike as regards economy and sanitary conditions, that the multitude of bad burners at present in use should be discarded, and that manufacturers should understand the proper principles for the construction of burners—a subject which will be fully treated of in the second part of this report.

T. Foster, Secretary.

Correspondence.

[Correspondents, in all cases, should sign their communications with their names and address in full—not necessarily for publication, but as a guarantee of good faith.—Eds.

Gas Meters.

Terre Haute, September 27, 1871.

Mr. Editor: Keeling has spoken—that wonderful man is an Englishman—he has "seen and been at the fighting of many a hard fought battle between the gas companies and the public," and yet he is not happy. He has left his native country—we hope it has not been for its good, but for his own. Like Ruth to Naomi he has said to us Americans: thy people shall be my people; thy gas company my gas company, but yet he is not satisfied; he delights in war; he snuffs the battle from afar, like the war horse we read about.

After two whole years in America, he has discovered that the gas companies here are a set of robbers; has found out that they are ravenous monopolies, who are cheating the public, because they do not furnish gas at half their present price.

If he should go to the butcher, whose scales he tells about, to buy a sirloin steak, and asking the price he should tell him 18 cents per pound, we wonder if he would blackguard him as a monopolist, because the price was high; and what the butcher would answer him, if he should say, "I can get a beefsteak in England at nine cents per pound!" I think he would be laughed at for his folly, and be told if he wanted to buy a steak for that price to go to England and get it. Yet the beef butcher is just as much a monopolist as the gas company, for he alone sells beef, and the gas company alone sells gas.

In the same breath in which he speaks of the gas company as a monopoly, he tells us that people that don't choose to use gas, burn "coal oil, kerosene, liquid gas, safety gas, carbon spirit," etc., and he might have added, whale oil, lard oil, paraffine, wax, sperm, and tallow candles, which are perfectly safe to use; thus conclusively showing that the gas company has no exclusive monopoly of light.

From the manner of his growling, we suspect that perhaps in the two years last past, he has neglected to pay his gas bills, and as a consequence has been compelled to make a "deposit"; he seems so sore on that subject that probably there is where the *shoe pinches*, and "that's what's the matter with John"; not having the "ready" it has acted as a "deterrent" and he has been compelled to fall back on a penny dip. Having, perhaps, been used to gas, I pity him.

I am glad of one thing—Keeling says he has taken to study, and as a result, at one fell swoop down goes dip pipe, stand-pipe, and hydraulic main, and I was going to add—up goes the retorts; but it has not come to that yet Perhaps, after more mature study, he may be able to do without *them*—who knows.

Next he goes at the gas meter, and evidently is talking about something he knows little about. Even on this subject, the "nigger can be seen in the wood pile." *My* patent governor and pressure indicator" tells the tale; by its help he makes a wonderful discovery! Hear the story: For three months a meter rated with the use of "my patent governor and indicator 15,000 feet per week, never varying 300 feet; in one week it went up to 18,000 feet (a very simple occurrence in a large factory). It was detected the first week (!); the meter was tested and found to be 20 per cent. fast." Now, does Mr. Keeling really think that any intelligent gas man would believe such a "cock and bull story" as that. That a meter burning right along, would, *in one week*, get 20 per cent. fast, without some local cause.

There might be tampering with the meter by somebody wanting to bolster up some pet device; in fact his article almost indicates that such a thing might have been done. Look at this. "Suppose the tangent which governs the revolutions gets misplaced, the meter is all at sea." He might as well say: Suppose a locomotive runs off the track, when a switch is left open! Now, how in the name of sense, is the tangent which governs, say a Glover meter, to be misplaced, *unless* the top is removed and the tangent manipulated by hand? It is a sheer impossibility, unless the wire which holds the arms from coming off is removed, and the lever subsequently taken off also. Then, and only then, could he make the meter go fast or slow at pleasure; the tangent might break, but in that case the meter would stop registering.

If a meter that I had charge of, in a given time should register 3000 feet more than ordinary, I should think that more gas was used in the factory during the period than previously; that a temporary leak had occurred; that the meter inspector might have made a mistake in taking the statement on a former, or on the present occasion—that some person had carelessly put something hot, near enough to the meter to affect the leather diaphragm, etc.; in fact the latter would be the only reasonable cause for the meter registering 20 per cent. fast in one week during continuous use; unless as suggested above, the meter was tampered with by unsoldering the top, manipulating the tangent, and re-setting the meter thus altered. We venture the assertion, and do not fear contradiction, that no such sudden change would take place in a meter from merely natural causes.

Aside from all this, the greater part of this talk about the gas meter is all bosh. It is one of the most perfect machines (for the purpose intended) that was ever invented. When manufactured it is made to pass a rigid examination before being sent from the factory, as an imperfect article would injure the reputation of the manufacturer. Besides this rigid inspection by them, several States have State Inspectors, whose business it is to again examine and stamp the meters used in those States; and from their printed reports we find that while a large number are exact, that none are passed that register two per cent. either for or against the consumer, and that where old meters have been inspected as many are likely to be found in favor of the consumer as in favor of the gas company. Also, that even where there are no State or City Inspectors (which latter is frequently the case) every large gas company has, in a suitable room provided for the purpose, a meter prover of their own, where any person having any doubts as to the accuracy of his meter can, by application, have the meter taken from the house and tested in the consumer's presence; and even if that should not prove satisfactory, I would suggest another plan, which could easily be adopted, even where there was no meter prover. Let the consumer go to the gas company's office, and selecting from any one of their new meters a certain meter, noting the maker's name and number of the meter; let him then, without the knowledge of the gas company, write to the manufacturer and obtain from them a certificate as to what that meter varied from 0 when manufactured by them; every meter company keeps an accurate record of each meter; then by attaching that meter and the meter you desire tested together, you can see if they both register alike, when any person can be satisfied as to the accuracy of his meter. This is a simple method, and should be satisfactory to all. R.

Cause of Boiler Explosions.

Cambridge, Mass., Sept. 27, 1871.

Mr. Editor: Professor Tyndall, in his work entitled "Heat considered as a Mode of Motion," makes a suggestion in regard to the causes of the explosion of steam boilers, which I am surprised not to have seen offered as a possible explanation of some of the many disasters of this kind that have recently occurred. Perhaps you will agree with me in deeming it important enough to be repeated in the columns of your Journal.

The suggestion is based upon the well known facts, that all water contains a large quantity of air in solution, and that the liberation of the air by the process of boiling, vastly increases the cohesion of the atoms of the water. This cohesion naturally retards the process of ebullition; so that water freed from its air by boiling, and allowed to cool in a corked vessel, upon a second application of heat, can be raised to a temperature of 100° and more above the ordinary boiling point, without ebullition. Not only so, but when the liquid does boil, having an enormous excess of heat stored up, its locked atoms part company with the violence of a spring which suddenly breaks under strong tension, and ebullition becomes explosion. For the discovery of this interesting property of water we are indebted to M. Donny, of Ghent.

In his observations upon these facts, Professor Tyndall says:

"It is very remarkable that a great number of locomotives have exploded on quitting the shed where they had remained for a time quiescent. The number of explosions which have occured just as the engineer turned on the steam is quite surprising. Now supposing that a locomotive had been boiling sufficiently long to expel the air contained in its water; *that* liquid would possess, in a greater or less degree, the high cohesive quality to which I have called your attention. It is at least conceivable that while resting previous to starting on its journey, an excess of heat might be thus stored up in the boiler, and if stored up, the certain result would be, that the engineer on turning on the steam would, by a mechanical act, produce the rupture of the cohesion, and steam of explosive force would instantly be generated. I do not say that this *is* the case; but who can say that it is not the case? We have been dealing throughout with a real agency, which is certainly competent, if its power be invoked, to produce the most terrible effects."

D. G. Haskins.

Gas Meter Controversy.

Knoxville, Tenn., October 6th, 1871.

Mr. Editor: I was much pleased to read in your last issue another instructive communication, from your "valued correspondent, Mr. John Keeling, Gas Engineer, late of England." I believe we have to thank the "Gibson Valve" controversy, for first bringing to light those highly interesting letters which have so often, of late, adorned the pages of the Journal.

I think Mr. Keeling deserves the thanks of the gas fraternity for the able manner in which he closed the controversy, by bringing out an entire new plan, that will not only supersede the "Gibson Improvement,' but every other improvement; it is to be regretted that, from some cause or other, his arrangements are not yet completed for publishing his plan to the world.

It is also gratifying to us that it has been reserved to our day, and our country, to produce in Mr. Keeling one who will forever cast such names as Clegg, Crossley, Alexander Wright, and Glover, who have had the honor heretofore of inventing, improving, and perfecting one of the most beautiful, ingenious, and accurate pieces of mechanism extant, the gas meter; for, although Mr. Keeling with his characteristic modesty, did not state that he had a better instrument for the purpose than the common meter, yet, I have no doubt, when he completes his retort house plan, he will turn his ingenious mind to inventing a new gas meter which will take the place of those now in use, and which he so unsparingly condemns. I hope Mr. Keeling does not mean to imply that our respected meter makers throughout the country, openly and constantly practise a fraud by selling incorrect meters; if so, he, to a very great extent, underrates the intel-

ligence of the American public, and imputes base and unworthy motives to the gas companies, and those connected with them—but perhaps in England he had better opportunities of observing these matters than we have here.

In conclusion, Mr. Keeling, in his attempt to demolish Mr. Gwynn's very practical suggestion to test the meter by a burner consuming so many feet per hour, says: "It is well known that a burner's consumption is governed by the pressure; a six feet burner at 4-10ths pressure will burn double this amount at 10-10ths, etc." Now what is the use of his Gas Governor and Indicator he advertises, if it will not keep the pressure at any given amount of 10ths, while the meter is being tested? Respectfully,

JAMES SOMERVILLE.

Water and its Purification.

The praises of pure water have been sung by poets and proclaimed by orators; and yet it is unfortunately true that absolutely pure water is a myth, while water sufficiently pure for the ordinary requirements of civilized is to be had with difficulty. The sparkling rill that descends the mountain-side contains matter that it has dissolved out of the soil and washed off the rocks; rain-water that has never been contaminated by the touch of anything earthy is still far from pure; and even the "beautiful snow," whose very name is an image of purity, contains ammonia and various other substances, washed out of the atmosphere. Still further: the ordinary distilled water of the chemist is not absolutely pure. Huxley asserts that he has not yet been able to obtain water microscopically pure, and it taxed the utmost skill of Sir Humphrey Davy to prepare water in which no impurity could be detected. But, while perfectly pure water is neither obtainable, nor perhaps even desirable, it is essential that the impurities present should not be such as can interfere with the processes in which the water is to be used. Thus water used in the manufacture of paper may contain many impurities, and yet answer the required purposes, but if it contained a small proportion of iron in solution, it would be rendered worthless. So for household purposes, water may contain several substances, and yet not be rendered unfit for use, while the presence of certain other impurities renders it dangerous, or at least disagreeable; and as potable, or drinkable water, is one of the absolute necessaries of life, and good water is one of the most important materials used in the arts, we propose to consider, in a brief and popular, but practical, manner, the nature of the impurities generally present, and their sources.

It may be safely stated that in general all the water used for domestic or other purposes is derived either from springs, wells, streams, or ponds, on the one hand, or from the clouds on the other. It is true that all water comes originally from the clouds; but, on passing through or over the earth, it parts with certain impurities, and takes up others. The impurities which exist in water that has passed through the air in the form of rain or snow, are chiefly ammonia, together with nitrates, sulphates, and chlorides. In localities near the sea, common salt (chloride of sodium) is frequently present in notable quantities; while in towns and cities, the rain and snow always contain marked quantities of the products of combustion, and always have a sooty taste. Snow-water has long been noted for its softness—this peculiarity being mentioned in the Book of Job, where the patriarch says, "If I wash myself with snow-water, and make my hands never so clean;" thus showing that the cleansing power of snow was a familiar fact in those days. This property is due to the presence of ammonia washed out of the air; snow, owing to its low temperature, having a special power of condensing and retaining this substance. When rain-water falls on the ground, it comes in contact with the soil, which absorbs the ammonia, together with the nitrates and most of the organic matter, and yields carbonate of lime, sulphate of lime, and various other alkaline and earthy salts. These latter become dissolved in the water, and render it *hard;* and, although when present in small quantity they do not usually produce serious difficulty, yet when existing in large proportion, they exert a very injurious action on the digestive apparatus. It must be remembered, however, that the *character* of the impurity is of more consequence than the *quantity* in which it is present. A very small amount of foreign matter derived from sewage may produce more evil than a very large amount of some saline matter. It has been claimed by some that calcareous salts are rather beneficial than otherwise, and that the experiments of M. Boussingault have clearly proved that the lime present in drinking-waters aids in the development of the bony skeletons of animals. It is also asserted that some of the diseases incident to the Alpine regions are caused by the use of snow-water, which is remarkably free from all impurity—particularly lime. As the character of the water found in any given locality is of the utmost importance to those who reside there, a careful examination of the water-supply ought always to precede the selection of a location for a residence. The absence of good water need not necessarily exclude a locality from favorable consideration, since rain-water, carefully collected in a clean cistern and properly filtered through an efficient filter, will answer every purpose; but, other things being equal, a locality in which wells of good water are found ought to have the preference.—*Technologist.*

Plumbago.

The value of plumbago—depending mainly on the amount of carbon it contains—is readily determined by the following method, described in an exchange:

The material to be tried, being finely pulverized, is dried at 350 deg. Fah. The dried mass is intimately mixed with twenty times its weight of carefully dried litharge, and the mixture introduced into a tube of hard glass, with a length of from four to five inches and a diameter of half an inch, sealed at one end. The tube and its contents are weighed and then treated before the blowpipe till a quiet and complete fusion take place, in time usually not greater than ten minutes. The tube is now allowed to cool and is then weighed, the loss of weight being carbonic acid—the product of the union of the carbon of the plumbago with a requisite amount of oxygen obtained from the oxide of lead. The molecular weight of carbonic acid being twenty-two, and consisting of one atom of carbon (six) and two atoms of oxygen (sixteen) gives us, in connection with the loss of weight, all the data requisite for calculating the amount of carbon. The balance is, of course, ashy matters: but the process of analyzing these is one of considerable difficulty, though sometimes it is quite essential that it should be done, since their nature and quantity must influence the adaptability of the plumbago to certain purposes.

The best samples of graphite show a range of carbon from about 55 to 95 per cent.; the famous Ceylon locality furnishing a variety containing about 88 per cent., while that from Mount Albert in the Ural, contains 94 per cent. of carbon. Nearly all specimens yield varying amounts of volatile ingredients—these ranging, in percentage, between 6, 7 and 8. The ash ingredients are silica, alumina, ferrous oxide, lime, magnesia, and small amounts of alkalies. The first named is the most abundant in the cinereal constituents. Formerly the iron was supposed to combine, as such, with the carbon, and the mineral, was described and named as a carburet of iron. It has, however, been shown that the iron in reality exists as an oxide—that it is in admixture, like the rest of the ash ingredients, with the carbon—and that it is, therefore, not essential to the constitution of the graphite. The most noted and often referred to localities of the mineral are those of Ceylon, the Ural, and Borrowdale in Cumberland, England. In this country, localities in Maine, New Hampshire, and North Carolina, yield large amounts of an article of considerable purity, and of commercial importance. The limestones and some other associated rocks of the Laurentian and Huronian series of Canada and Lake Superior contain isolated patches, as well as concentrations of considerable magnitude of both the true plumbago and of the foliated variety or graphite; but we are not aware that commerce and industry have as yet made any demand upon them. The origin of these deposits has always been a subject of considerable discussion among geologists; but perhaps Wagner's observations respecting the production of graphite from cyanogen compounds, may yet furnish a key for the solution of the problem.—*Jour. of Applied Chemistry.*

Lithofracteur.

[Condensed from "Engineering."]

Lithofracteur—literally stone-breaker—is the patented invention of Prof. Engels, of Cologne, and is composed of nitro-glycerine as a base, gun-cotton, the constituents of gun-powder, some chlorates, and an infusorial earth. These substances are prepared in a special way, and blended together by special means, the details of these operations being known only to the inventor and the manufacturers, Messrs. Gebruder, Krebs & Co., of Cologne. The result of this combination is a black compound of the consistence of soft putty, which is made up into paper cartridges 4½ in. long by ⅞th of an inch in diameter, and weighing 1¾ oz. each. When lighted in the air it simply burns out, leaving a light white powder as a residuum, but when it is ignited either in the air or in a closed chamber with a capped fuse, its full violence is developed. It is safe under all ordinary and even extraordinary circumstances of storage and transit, as recent experiments in England and lengthened use on the Continent have proved. And here we may mention that, although this is almost the first time we in England have heard of this substance, it has been made and extensively used throughout Germany for more than two years past. It was used by the Prussians against the French during the recent war, Herr Engels being the operator. After Fort Issy was taken the Prussians destroyed a number of heavy French siege guns by blowing off their muzzles with lithofracteur.

A notice of this material having appeared in the German papers, the attention of the mining world in England was attracted to it, and experiments were commenced on Tuesday morning at the Nant Mawr quarries, about 23 miles from Shrewsbury.

The preliminary experiment consisted in throwing 5 lbs. of lithofracteur from a height of 150 feet. The box was smashed and the cartridges were scattered about, but not exploded. A cartridge was then lighted by an ordinary fuse, when it burned slowly out. Another cartridge was then placed upon a block of stone and fired with a percussion fuse, when the top face of the stone was broken off. The power of the lithofracteur when confined was then exhibited by firing charges in the bore-holes of several blocks of stone, which were shattered into many fragments. The tamping in all cases was effected with water, thus proving the usefulness and reliableness of the compound in wet ground. Another point proved was that if a missfire should occur—and one or two did occur in the course of the experiments—the charge could be withdrawn—and another one inserted without removing the tamping.

[Experiments were then made, apparently of the most energetic kind, and varied in every way, in endeavoring to explode the composition by impact of rail cars running down steep inclined planes and having the lithofracteur smeared on their buffers. No explosion followed in any case. This was done to prove that the English law against transportation of nitro-glycerine in any form, by rail or otherwise, is needless with this composition.]

How to Test Kerosene Oil.

The great risk that attends the use of an oil of a dangerously inflammable nature, makes it desirable that every person should have at hand, and be able to apply, some easy and reliable test by which he may ascertain the quality of every gallon that he may purchase. Much the larger proportion of fires in dwelling houses, and of accidents resulting in burns, occurs from the explosion of kerosene oil lamps. With oils volatilizing at a high degree, the danger of explosions is reduced to a minimum, but such oils are, unfortunately, but rarely used by the generality of people. Cheapness induces the people to very commonly use such oils as are convertible into a highly explosive gas or vapor at a much lower temperature than 140 deg. The common mode of testing oil, by placing a small quantity in a saucer and applying a lighted match, is not always reliable. The vapor given off is much mixed with air, or is removed by air currents as fast as formed, and may thus deceive the investigator by refusing to flash into flame. But if the same oils were put to a more accurate test, they would be at once condemned.

We borrow from the *Scientific American*, a description of a very simple and easily operated test, by which the character of a sample of oil can be accurately ascertained. A test tube of half an inch diameter and eight or ten inches in length, closed at one end, is filled with oil to within a quarter of an inch of the rim. It is then allowed to remain at rest for a few moments to get rid of any bubbles of air that may be intermixed, and when free from them is completely filled, and the open end stopped closely with the finger or thumb. A small bowl of water of a temperature of 110 deg. being at hand, the tube of oil is inserted—the open end downwards—to the bottom of the bowl, and the finger is withdrawn. The heat is maintained, during the experiment, by the addition of hot water as required. If the quality of the oil is not up to the standard, vapor will be freely generated, and will rise in bubbles to the top of the tube, dis-

placing the oil. The quantity of oil displaced will become a test of the relative qualities of the samples operated on, the lighter oils generating much larger amounts of gas.—*Exch.*

[Instruments for this purpose, founded on this principle of the tension of the vapor, have been for some years in use here. We believe we owe the first application of this kind to Prof. C. A. Seely, of this city.—Ed.]

Liquid Glues.

A correspondent of the *Scientific American* makes the following singular, and we should think rather dubious statement in relation to liquid glues:

"An excellent liquid glue is made by dissolving glue in nitric ether. The ether will only dissolve a certain amount of the glue; consequently, the solution cannot be made to thick. The glue thus made is about the consistency of molasses, and is double as tenacious as that made with hot water. If a few bits of india-rubber, cut into scraps the size of a buck shot, be added, and the solution allowed to stand a few days, being stirred frequently, it will be all the better, and will resist dampness twice as well as glue made with water. The best liquid glue that I have any knowledge of is made as follows: Take of gum shellac three parts; caoutchouc (india-rubber) one part, by weight. Dissolve the caoutchouc and shellac, in separate vessels, in ether free from alcohol, applying a gentle heat. When thoroughly dissolved, mix the two solutions, and keep in a bottle tightly stoppered. This glue is called marine glue, and resists the action of water, both hot and cold, and most of the acids and alkalies. Pieces of wood, leather or other substances, joined together by it, will part at any other point than at the joint thus made. If the glue be thinned by the admixture of ether, and applied as a varnish to leather, along the seams where it is sewed together, it renders the joint or seam water tight, and almost impossible to separate. The natives of the Maldive and Lacadive Islands, and the Malays, of the coasts of Borneo and Sumatra, have a glue which they make as follows; They take the scales of a kind of fish, called by the English and American sailors salt-water trout, (identical with the salt water trout of the Gulf of Mexico,) and after thoroughly washing them, place them in a glazed earthen jar, which they stopper tightly, and weight so that it will remain under water. They put this jar in a pot of water, and boil it until the scales are reduced to a semi-transparent viscous mass. This requires several hours boiling. Care should be taken that no water or extraneous matter, fluid or solid, be allowed to get into the jar with the scales. The glue thus made is the most tenacious, and at the same time the most transparent and beautiful that I have ever seen. I have made it in this country from the scales of perch, trout, and bass. I am informed that a similar glue is made from the bladders of various fishes."

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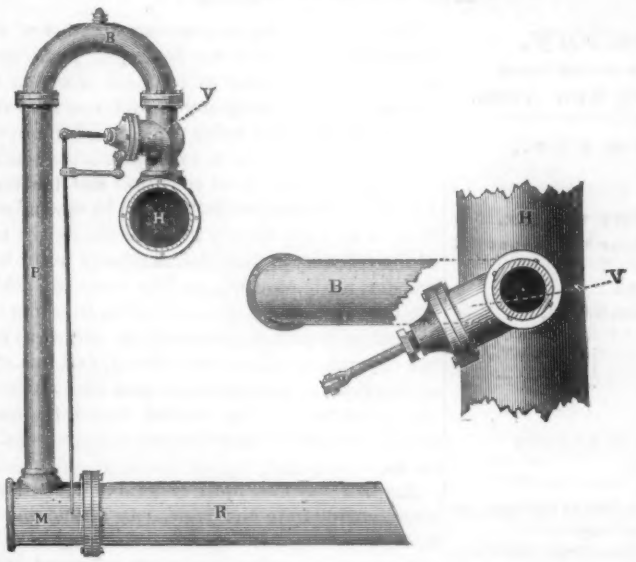

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RECENT AMERICAN PATENTS.

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118,903.—Hydrocarbons.—J. K. Caldwell, Philadelphia, Pa.
118,936.—Gas Retort.—J. D. Higgins, Rome, N. Y.
118,967.—Gas.—R. Morton, London, England.
118,983.—Carburetter, Etc.—H. C. Terry, Brooklyn, N. Y.
119,003.—Water Meter.—H. M. Bartlett, South Dedham, Mass.
119,034.—Gas.—J. Kidd, New York city.
119,135.—Coal Gas.—W. Gibson, Cambridge, Mass.
119,225.—Generator.—J. Eberhardt, Conshohocken, Pa.
119,227.—Gas.—E. B. Fogarty, Brooklyn, N. Y.
119,257.—Generator.—S. L. Wiegand, Philadelphia, Pa.
119,310.—Generator.—G. F. Burkhardt, Boston, Mass.
119,347.—Lamp Post.—J. W. Graham, Chillicothe, Ohio.

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☞ All communications to be addressed to "THE EDITOR, No. 42 Pine Street, Room 18, New York.

MONDAY, OCTOBER 16, 1871.

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS*, or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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General Editorials.

THE REFEREES' REPORT ON BURNERS.

In this issue we conclude our abstract of this document, on which we have put forth some careful labor, in order to condense it within our limits, without losing any of its essential substance, the original being considerably more verbose and diffuse than is appropriate in treatises addressed especially to scientists and technists. In issue of September 16th, it will be remembered that we took the liberty to deprecate on the part of the referees, certain violent attacks from a high quarter, made on them, on this score, we taking the ground that the general public, to whom this Report is certainly addressed, in common with gas experts, would, as we believed, find this style appropriate to the occasion; and that moreover the substance of the report would be found highly acceptable and deemed highly useful to them.

English journals, both general and technical, since, corroborate our view. An article in the London *Spectator* is before us, and may be taken as an exposition of the general judgment of the British public; as well as what we think would be that of our own people, were it possible to put this report generally before them: an end to which our own utmost efforts are necessarily inadequate, by reason of the outrageous stupidity of the secular press of this country, and its incredible insensibility to the invaluable character of the contents of our own columns.*

The *Spectator* after reverting to the discomfort, dirt, danger and expense of the oil-lamps and candles of the "good old times" of merry England, comes down to what seems to us a considerably over-colored picture of the heat, unhealthiness, eyesoreness, stench, smoke and soot of gas, passes to a consideration of the delays, disorder, and extortion introduced by the gas-fitter when called in to remedy teese evils, then passes on to the Gas Referees Report, which it characterizes as a "shrewd, sensible and perfectly clear statement of the way to get rid of all our troubles," and commends it to its readers, as "an easy remedy within our reach." This, while it may be rather exaggerated laudation, certainly proves the existence of a demand for this sort of information put into popular and practical form, which is to a great extent gratified by this report, which we have laboriously condensed for our readers.

The *Spectator* says: "We are quite sure, making a very rough estimate of certain cases within our own knowledge, that the outlay needed for providing the proper means of consuming gas in a household, will be more than covered by a twelvemonth's saving in gas bills and gasfitters charges." This gives us a chance to say something we have for some time wanted to say. It is common for gas men, in this country, to object, ostensibly on grounds of *policy* (of manufacturers), to the general dissemination of this sort of knowledge, in popular form. We say ostensibly, because we have a shrewd notion that the real motive, or rather the strongest one, is objection to innovation, of any kind. If any really believe that it is a true policy, that is, that reduction of cost of gas, or rather of light, must needs lead to reduction of general consumption and of profits, we beg respectfully but firmly, to dissent. We believe that this is distinctly one of those common cases in which every reduction of cost, and increase of convenience and comfort, leads quickly and inevitably to a far more than proportionate increase of consumption.

We have already in type for next issue, a Report of Prof. W. H. Chandler, on the Dublin Gas Works in which he illustrates strongly this fact, by comparison of the relative costs and consumpts in Dublin and New York.

This important subject of burners will in the future occupy in our columns all the space we can give to it, without displacing other subjects of parallel importance. The "Report on Ammonia" will appear, in similar abstract, in our next.

To mitigate the withering and inevitable effect of the above fulmination, we shall mercifully add that we wish fully to recognize a few honorable exceptions. For example, the *Brooklyn Daily Eagle*, the *Memphis Appeal*, and a few others, who frequently compliment us by quoting matter of general interest.

THE CAUSE OF BOILER EXPLOSIONS.

In our "Correspondence" to-day, is an interesting and intelligent communication, from Mr. Haskins, of Cambridge, Mass., to which we desire to add some words of comment. It relates to the property of water free from air, when at rest, to become "superheated," or supersaturated with steam, as some call it, and then to give off steam explosively when agitated.

We do not think that the suggestion of this as a cause of boiler explosions was original with Professor Tyndall, as it has been a familiar idea to us since long before the publication of "Heat as a Mode of Motion." The same explanation was many years ago made, of the phenomena of the Iceland Geysers, and other intermittent explosive boiling springs. We have long believed it to be the true cruse of numerous boiler catastrophes, and have supposed this belief to be wide-spread among those who study the subject from a chemical point of view. There are even a number of patented inventions founded on this action. Mr. Haskins is mistaken also in supposing that this theory has not recently been reproduced to the public. Our impression is that it was distinctly enunciated by one or more of the expert witnesses in the Westfield investigation, and we are confident that we have seen several communications in the *Scientific American* and other journals, commenting upon this same fearful occurrence, in which it was very plausibly attributed to such a condition of the water in the boiler. We are nevertheless pleased that Mr. H. has brought up this subject in our columns, as it is one with which many practical men are not as familiar as they ought to be. It is very easy to produce the phenomenon, both with water and other liquids, in *glass* or polished vessels, as chemists in the laboratory know to their cost and frequent detriment, the troublesome occurrence known as the "bumping" of boiling liquids, being attributed thereto, for example; but there has been a generally prevailing notion that in vessels having *rough* internal surfaces, like a steam boiler, it could not be, or had never been, produced or observed. We therefore see that there is here, still a most important and vital point in steam science, which has not yet been satisfactorily settled, and requires much further investigation.

THE CHICAGO HOLOCAUST.

"The wooden pavements even took fire, making a continuous sheet of flame two miles long by a mile wide."—*New York Tribune Report.*

What a picture is presented here to the mind's eye. A long straight wide street, floored as smoothly as a room, in this much vaunted way.

The wind sweeping in a gale along this street and gradually flooring it with roaring billows of flame, propagated from one end; and communicating thence to the doomed houses on either side.

At the time when wooden pavements first came into vogue (we believe they came to us from these western cities, at least the present peculiar crop of inventions of this kind) we ourselves joined strenuously with others in deprecating their adoption, on many grounds, one of which was this liability to propagate fire from place to place. This objection was looked at, and even laughed at, as visionary. How was such a wedged-in mass of fibre, presenting its ends only, to be kindled at all into a blaze. Why you might kindle a bonfire on it and only carbonize the surface to a slight depth.

Having a chemist's appreciation of the tremendous capabilities and cumulativo power of fire, we ventured still to differ from our deriders, and urged that at least the wood used should be impregnated, for preservative purposes, instead of with tarry products, with those of a fire-proofing nature, like chloride of calcium, chloride of aluminum, and the like, which are well known to be scarce, if any, less preservative in their power. This was about nine years since. No heed was taken.

We have since urged that wood employed for many other purposes, as for example in the building of railroad cars, and even dwellings, should be prepared by similar means. In the columns of this Journal we have repeatedly tried to obtain a hearing and a consideration for our plans. We once (it was just after one of the horiffic bonfires on the Erie Railroad of mixed vegetable and human fibre) addressed a note to the New York *Tribune* itself, setting forth many chemical reasons for a preference of such prepared wood to iron, for railroad cars. This note, we presume, was consigned to "the tomb of the Capulets," as we never heard more of it. *Jam satis* for the present.

THE IMPROVED GIBSON VALVE.

In our last reference to this subject, in issue of September 2d, we closed by saying that we should shortly have much new and important matter thereon to lay before our readers. In this issue we begin the redemption of this promise, by the presentation of still further improvements, forming the subject of a new patent. The object of this new improvement is to obviate the possibility of accident arising from a neglect of the workman to open the valve before closing the retort.

The many eminent gas engineers who have been consulted and advised with, regarding the use of these improvements, have generally concurred in the necessity of such a provision or protection. This has induced the inventor to give his earnest attention to this point, and the result, after much careful consideration and examination of the conditions involved, has been the device now presented.

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and we are now prepared to treat with you for the use of said process by your Company.

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We do not deem it necessary to enter upon a detailed description, here, of the processes above referred to, deeming it sufficient to state, to secure your interest and investigation, that they have been in successful operation, for months, in a number of Gas-Light Works in the United States, and are now being introduced in the works of the Mutual Gas-Light Company, of New York City; the Citizens' Gas-Light Company, of Brooklyn; the New Orleans, San Francisco, and very many other Gas-Light Companies throughout the country.

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248-tf] **P. O. Box 5220, New York City.**

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GAS SCREEN MANUF'G COMP'Y.

LETTERS OF INTEREST TO GAS LIGHT COMPANIES and Superintendents of Gas Works needing new Gas Trays, or Screens, for another season.

Which are the best and cheapest?

We refer to over sixty companies *now* using them.

BROOKLINE, June 17, 1871.

E. DUFFEE, ESQ.:

Dear Sir: You will please make a set of Gas Trays for this Company as soon as convenient, at price named.

In regard to the merits of the Tray, after having them in constant use for over two years, I will say that I consider them *superior to any Tray* manufactured in this country.

Respectfully Yours,
H. A. ALLYN,
Superintendent Brookline Gas-Light Co.

EAST BOSTON, June 15, 1871.

Gentlemen: We have used your Screens some five years they give perfect satisfaction.

I consider them *by far the best Screen* for Dry Lime Purifiers I have seen.

Yours truly,
A. M. NORTON,
Supt. East Boston Gas-Light Co.

CHELSEA, May 1, 1871.

Mr. E. DUFFEE:

We are using your Purifying Trays, and find them to be the *best of any* that I have used, and will *purify more gas with less pressure* than any tray that I know. I can fully recommend them, after four years trial, to any Gas Superintendent with perfect safety, as the *cheapest and best Tray made.*

Yours truly,
JOHN ANDREW, Supt.

JAMAICA PLAINS, MASS., June 21, 1871.

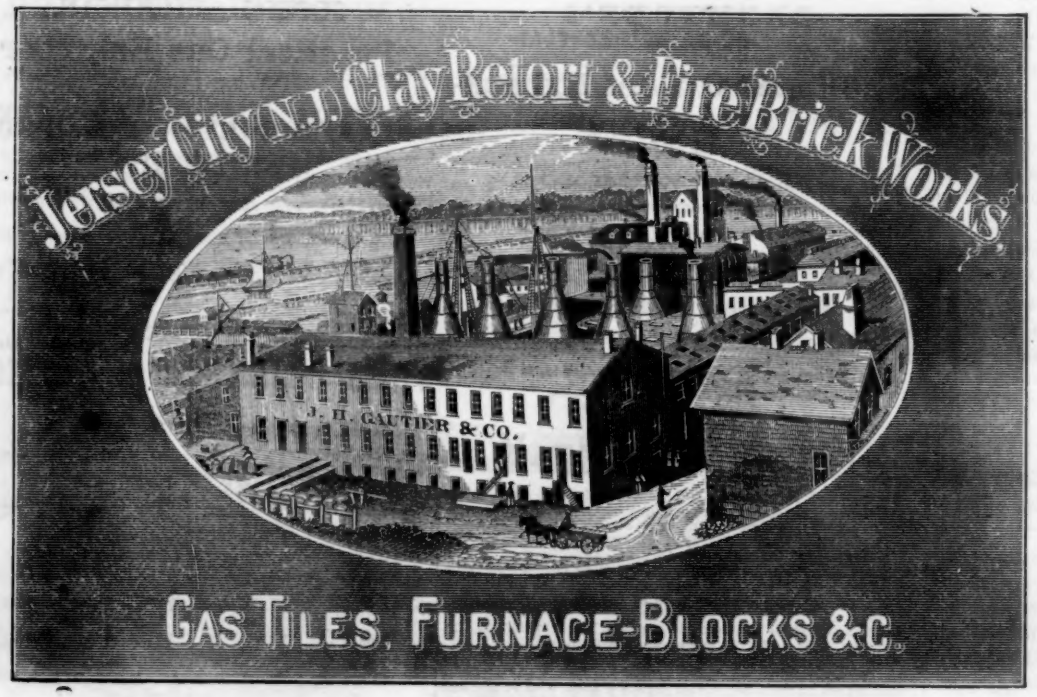
EDWARD DUFFEE, ESQ:

Dear Sir: The Trays ordered by this Company three years ago, are getting somewhat worn. I wish to say here that I consider your Trays to be superior to any yet invented, therefore please make us another set at the price named, to be like the sample shown in every way, and oblige. Yours truly,
JAMES F. ROGERS,
Supt. Jamaica Plains Gas-Light Co.

Also see letter from Providence, R. I., in another column.

It will be for the interest of all Gas-Light Companies needing new Trays another season, to give their orders early, to be delivered where wanted, as we were unable to fill orders promptly to Companies ordering late last fall.

American Gas Screen Man'f'g Company,
Haverhill, Mass. 246-3m



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The Mackenzie Patent Gas Exhauster

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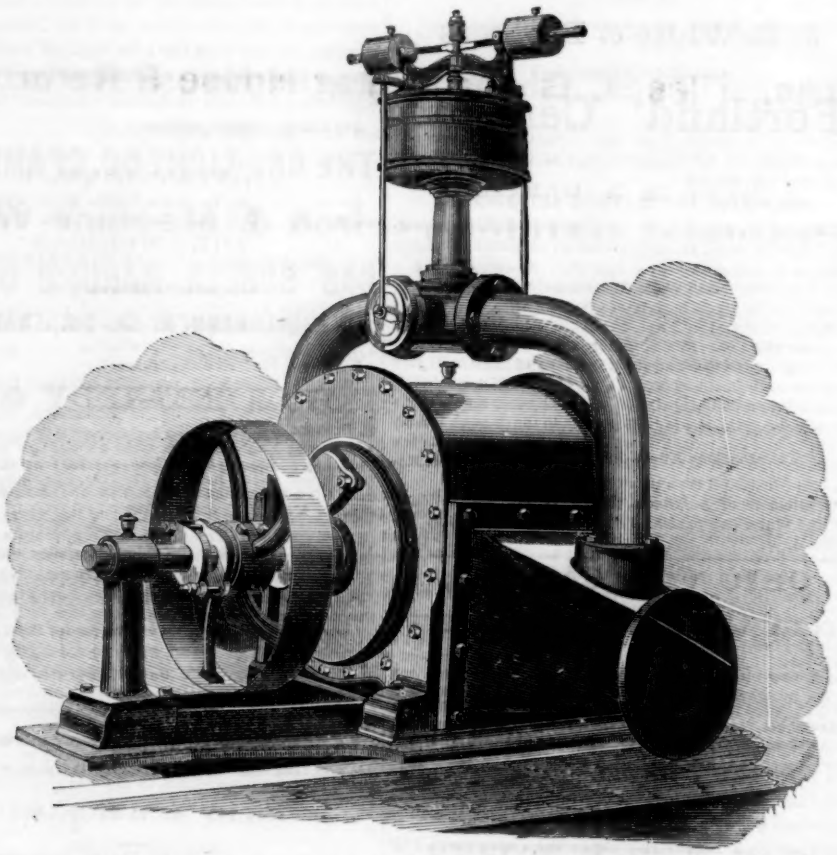

They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating of the gas, and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely necessity of water-joints, is compact, durable, cleanly, not liable to get out of order, self-acting, quiet, and certain in its ation.

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J. W. GRAHAM,

Dear Sir: Yours of the 14th inst at hand. In reply I would say that we have tested the six anti-freezing Lamp Posts purchased from you, and find them to be all as you represented. Whilst nearly a dozen of our sixty-five Posts were frozen down last month and first of this not one of yours was affected by the heavy frost. What can you sell them at?

Yours truly,
LUCAS FLATTERY,
Sec'y Wooster Gas-Light Co.

Address the Patentee,

J. W. GRAHAM,
Chillicothe, Ohio.

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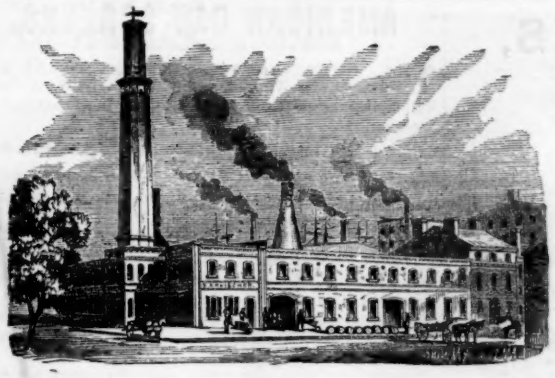

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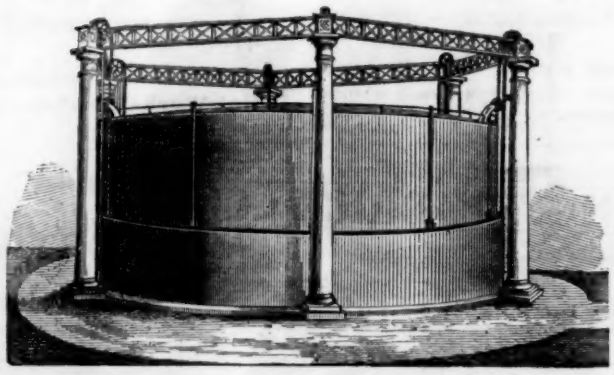

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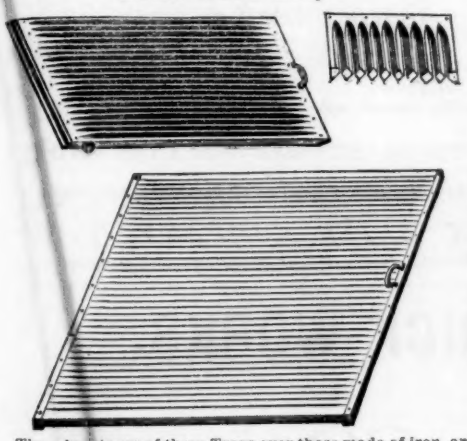

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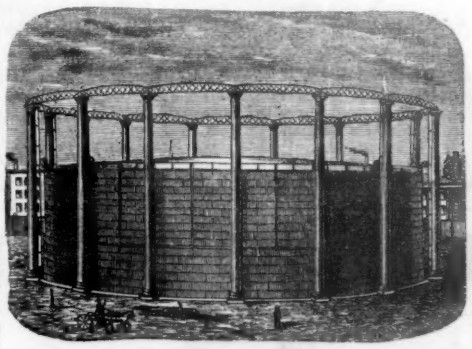

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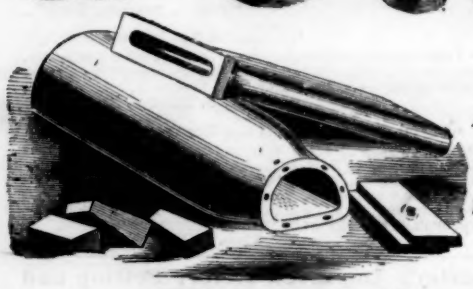

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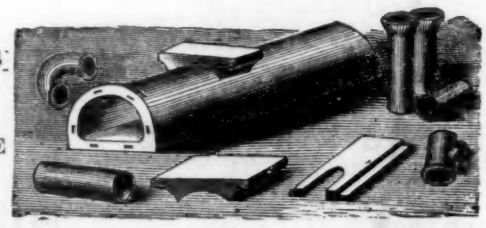

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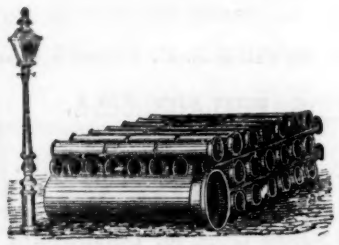

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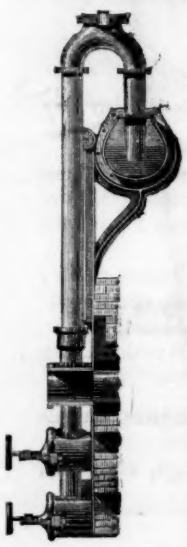

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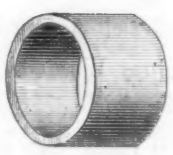

FIG. 2.

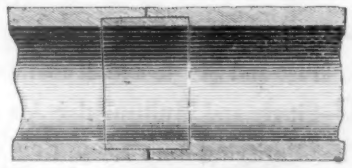

FIG. 3.

A—Cylinder of Wood. B—Band of Iron. C—Coating of Hydraulic or Asphaltum Cement.

FIG. 2.—Thimble for Connection. FIG. 3.—Horizontal Section and Connection.

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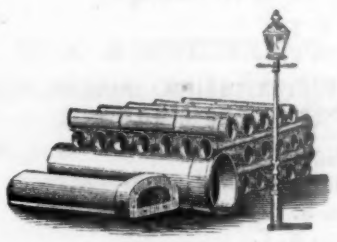

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